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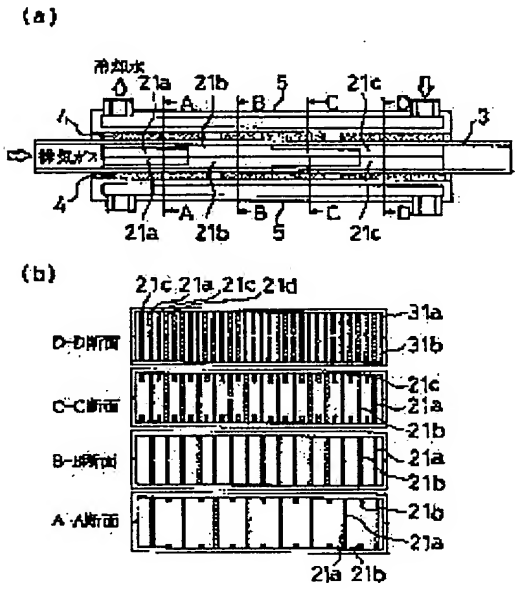
(54) EXHAUST HEAT GENERATOR FOR AUTOMOBILE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent deformation of a surface of an exhaust pipe due to a pressing load of a generating module against the exhaust pipe and increase of contact heat resistance on an exhaust heat generator.

SOLUTION: A pressing load of a generating module 4 is supported by a heat collection fin 21a by constituting a beam member to cross in the vertical direction by striking the heat collection fin 21a erected on a vertical inwall against the neighbourhood of a central surface on an exhust pipe 3 on which the generating module 4 is provided. Additionally, temperature of a high temperature end of the generating module is controlled constant by increasing height of a heat collection fin 21b which is low in height on an upstream end on the downstream side, increasing height of a heat collection fin 21c provided from an intermediate position on the downstream side and increasing the number and height of the collection fins larger and higher toward the downstream side.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The exhaust heat power plant for automobiles characterized by preparing the beam member supporting said forcing load in the interior of said exhaust pipe in the exhaust heat power plant for automobiles which forces and attaches the elevated-temperature edge of a generation-of-electrical-energy module in the external surface of the exhaust pipe which derives the exhaust air from an engine, and collects emission temperature energy as electrical energy with this generation-of-electrical-energy module.
[Claim 2] The exhaust heat power plant for automobiles according to claim 1 characterized by being the configuration of said exhaust pipe with which the elevated-temperature edge of said generation-of-electrical-energy module is forced being formed in the cross-section configuration of a flat abbreviation rectangle, and forcing and attaching the elevated-temperature edge of said generation-of-electrical-energy module to the long side of this rectangle cross section.
[Claim 3] The exhaust heat power plant for automobiles according to claim 1 or 2 characterized by forming said beam member in the shape of [which crosses said interior of an exhaust pipe as **** in said forcing direction, and is installed by the vertical flow direction as ****] a wall.
[Claim 4] The exhaust heat power plant for automobiles according to claim 3 characterized by making said beam member and parallel set up a collection-of-heat fin.
[Claim 5] The exhaust heat power plant for automobiles according to claim 4 characterized by the downstream of said exhaust pipe making at least one side of the height of said collection-of-heat fin, and a number increase.
[Claim 6] said forcing direction -- abbreviation parallel -- and the exhaust heat power plant for automobiles according to claim 3 characterized by constituting so that the downstream of said exhaust pipe may make the height of the collection-of-heat fin which the wall of said exhaust pipe was made to set up as **** increase to a vertical flow direction and said collection-of-heat fin may serve as said beam member by the downstream.
[Claim 7] The exhaust heat power plant for automobiles of any one publication of claim 1-6 characterized by considering as the configuration which is set up by the exhaust pipe wall, is set up by the tip of a ******** member, and the exhaust pipe wall of another side in the longitudinal plane of symmetry of said exhaust pipe, and compares the tip of a ******** member to the longitudinal plane of symmetry of said exhaust pipe also in said forcing direction.
[Claim 8] The exhaust heat power plant for automobiles of any one publication of claim 1-6 characterized by considering as the configuration which is set up by the exhaust pipe wall, is set up by the tip of a ******** member, and the exhaust pipe wall of another side in the longitudinal plane of symmetry of said exhaust pipe, and puts plate-like part material between the longitudinal plane of symmetry of said exhaust pipe between the tips of a ******** member also in said forcing direction.
[Claim 9] The exhaust heat power plant for automobiles according to claim 8 characterized by for the beam member set up by one [said] exhaust pipe wall and the beam member set up by the exhaust pipe wall of said another side shifting, and arranging it mutually in the direction which intersects perpendicularly in said forcing direction.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the equipment which collects engine emission temperature energy as electrical energy in detail about the exhaust heat power plant for automobiles.
[0002]
[Description of the Prior Art] Conventionally, as an exhaust heat power plant for automobiles, there were some which are indicated by JP,6-081639,A, JP,8-261064,A, and JP,10-234194,A.
[0003] This thing contacts the other side faces of this generation-of-electrical-energy module in a water cooling type or the air-cooled cooling section while it contacts one side face of a generation-of-electrical-energy module to the outside surface of the exhaust pipe which derives the exhaust air from an engine and attaches it in it.
[0004] Said generation-of-electrical-energy module consists of thermoelement ingredients, such as a semi-conductor, generates electricity using the Seebeck effect, produces a temperature gradient by the low cooling section of an exhaust pipe with high temperature, and temperature between the elevated-temperature edge of a generation-of-electrical-energy module, and a low-temperature edge, and generates electricity. Generally the effectiveness of said generation-of-electrical-energy module becomes so large that [, so that the temperature of an elevated-temperature edge becomes high, and] the temperature gradient between an elevated-temperature edge and a low-temperature edge becomes large.
[0005]
[Problem(s) to be Solved by the Invention] By the way, in order to aim at improvement in fuel consumption of an automobile with said exhaust heat power plant, the low-temperature edge temperature of a generation-of-electrical-energy module is low as much as possible, and elevated-temperature edge temperature is brought as much as possible close to an exhaust-gas temperature, and it is necessary to make it become high that it is necessary to obtain the maximum generation-of-electrical-energy output in an engine low-power output field, and the temperature gradient of the elevated-temperature edge temperature of a generation-of-electrical-energy module and low-temperature edge temperature should be made as large as possible in the condition that an exhaust-gas temperature is low, for that purpose.
[0006] For this reason, at the former, it is made to make contact thermal resistance as small as possible by enlarging the attachment load between the cooling section and a generation-of-electrical-energy module and between an exhaust pipe and a generation-of-electrical-energy module (forcing load).
[0007] However, the exhaust pipe with which a generation-of-electrical-energy module is attached Since it was considering as the configuration which is formed in the cross-section configuration of a flat abbreviation rectangle that a flat installation area of a generation-of-electrical-energy module should be secured, and forces and attaches the elevated-temperature edge of a generation-of-electrical-energy module to the long side of this rectangle cross section, If an exhaust pipe and a generation-of-electrical-energy module are attached by the big attachment load, the long side of the rectangle cross section of an exhaust pipe will bend. While the touch area of the elevated-temperature edge of a generation-of-electrical-energy module and an exhaust pipe fell, the planar pressure of the contact surface fell, contact thermal resistance increased by this, and there was a problem that a generation-of-electrical-energy output declined.
[0008] preventing deformation by the attachment load of the exhaust pipe with which this invention is made in view of the above-mentioned trouble, and a generation-of-electrical-energy module is attached -- it is -- increase of contact thermal resistance -- preventing -- with -- **** -- it aims at offering the exhaust heat power plant for automobiles which can prevent the fall of a generation-of-electrical-energy output.
[0009] Moreover, while preventing deformation by the attachment load of said exhaust pipe, it aims at offering the exhaust heat power plant for automobiles which can adjust thermal resistance according to a vertical style location.
[0010]
[Means for Solving the Problem] Therefore, the exhaust heat power plant for automobiles concerning invention according to claim 1 forced and attached the elevated-temperature edge of a generation-of-electrical-energy module in the external surface of the exhaust pipe which derives the exhaust air from an engine, and considered it as the configuration which prepares the beam member supporting said forcing load in the interior of said exhaust pipe in the exhaust heat power plant for automobiles which collects emission temperature energy as electrical energy with this generation-of-electrical-energy module.
[0011] According to this configuration, it pushes by the beam member prepared in the interior of an exhaust pipe, the reinforcement to a load is made, and deformation by the forcing load of an exhaust pipe is inhibited. In invention according to claim 2, said exhaust pipe with which the elevated-temperature edge of said generation-of-electrical-energy module is forced was formed in the cross-section configuration of a flat abbreviation rectangle, and considered as the configuration which forces and attaches the elevated-temperature edge of said generation-of-electrical-energy module to the long side of this rectangle cross section.
[0012] According to this configuration, an exhaust pipe is formed in the cross-section configuration of a flat abbreviation rectangle, a generation-of-electrical-energy module is attached in the long side of this rectangle cross section, and the forcing load of the direction which intersects perpendicularly with said long side supports by the beam member inside an exhaust pipe.
[0013] In invention according to claim 3, said beam member considered as the configuration formed in the shape of [which crosses said interior of an exhaust pipe as **** in said forcing direction, and is installed by the vertical flow direction as ****] a wall.
[0014] According to this configuration, a beam member is formed in the shape of [which divides the interior of an exhaust pipe] a wall, and is forced by the beam member of the shape of this wall, and a load supports it. Moreover, this beam member may function also as a collection-of-heat fin.

[0015] In invention according to claim 4, it considered as the configuration which makes said beam member and parallel set up a collection-of-heat fin. According to this configuration, the collection-of-heat fin which carries out the collection of heat of the exhaust air heat to the beam member of the shape of a wall established in order to support a forcing load at parallel, and is transmitted to a generation-of-electrical-energy module is set up, and exhaust air heat is made to be transmitted to a generation-of-electrical-energy module efficiently.
[0016] In invention according to claim 5, at least one side of the height of said collection-of-heat fin and a number was considered as the configuration to which the downstream of said exhaust pipe makes it increase. If the height and/or number of collection-of-heat fins are increased according to this configuration, since a heating area increases, it will be inhibited by increasing the height and/or number of collection-of-heat fins in the downstream to which an exhaust-gas temperature falls that the temperature of the elevated-temperature edge of a generation-of-electrical-energy module falls by the downstream.
[0017] invention according to claim 6 -- said forcing direction -- abbreviation parallel -- and the downstream of said exhaust pipe made the height of the collection-of-heat fin which the wall of said exhaust pipe was made to set up as **** increase to a vertical flow direction, and it constituted so that said collection-of-heat fin might serve as said beam member by the downstream.
[0018] According to this configuration, the collection-of-heat fin was considered as the configuration which can support a forcing load by the downstream, functioning also as a beam member which pushes by increasing the height and supports a load, and demonstrating the adjustment function of the thermal resistance by change of the collecting area of a collection-of-heat fin, although functioned only as a collection-of-heat means in the upstream. Although it is made to function also as a beam member as a big collecting area in the downstream to which an exhaust-gas temperature falls since thermal resistance cannot be adjusted unless a beam member can demonstrate the function as a collection-of-heat fin and has change of a collecting area throughout a vertical style if it puts in another way, in the upstream with a high exhaust-gas temperature, it considers only as the function of a collection of heat, without making it function as a beam member by reducing a collecting area.
[0019] In invention according to claim 7, also in said forcing direction, it was set up by the exhaust pipe wall and considered as the configuration which is set up by the tip of a ******** member, and the exhaust pipe wall of another side in the longitudinal plane of symmetry of said exhaust pipe, and compares the tip of a ******** member to the longitudinal plane of symmetry of said exhaust pipe.
[0020] According to this configuration, for example, said exhaust pipe is considered as the half-rate configuration carried out 2 ****s at the flat surface which intersects perpendicularly in said forcing direction, when these half-rate components are combined, the beam member which each of half-rate components was made to set up is compared in an abbreviation longitudinal plane of symmetry, and the beam with while [from an exhaust pipe wall to / beam / the exhaust pipe wall of another side] in the forcing direction is constituted.
[0021] In invention according to claim 8, it considered as the configuration which is set up by the exhaust pipe wall, is set up by the tip of a ******** member, and the exhaust pipe wall of another side in the longitudinal plane of symmetry of said exhaust pipe, and puts plate-like part material between the longitudinal plane of symmetry of said exhaust pipe between the tips of a ******** member also in said forcing direction.
[0022] According to this configuration, the plate-like part material put between the tips of a beam member will support the load of the direction where the root part of a beam member falls. In invention according to claim 9, the beam member set up by one [said] exhaust pipe wall and the beam member set up by the exhaust pipe wall of said another side considered as the configuration mutually arranged by shifting in the direction which intersects perpendicularly in said forcing direction.
[0023] Since according to this configuration the beam member set up by one exhaust pipe wall and the beam member set up by the exhaust pipe wall of another side shift and is arranged, when a beam member carries out thermal expansion, for example, it becomes possible to make said thermal expansion absorb by bending of plate-like part material, respectively.
[0024]
[Effect of the Invention] according to invention according to claim 1, the forcing load of a generation-of-electrical-energy module supports by the beam member -- deformation of an exhaust pipe -- it can inhibit -- with -- **** -- it is effective in the ability to inhibit the fall of the generation-of-electrical-energy output by the fall of the touch area of the elevated-temperature edge of a generation-of-electrical-energy module, and an exhaust pipe, and the planar pressure of the contact surface.
[0025] According to invention according to claim 2, securing a large installation area by the flatness of a generation-of-electrical-energy module, deformation of an exhaust pipe is inhibited and it is effective in the ability to obtain an expected generation-of-electrical-energy output.
[0026] According to invention according to claim 3, it is effective in demonstrating the function as a collection-of-heat fin, supporting a forcing load. According to invention according to claim 4, it is effective in the ability to transmit efficiently the heat of the exhaust air which flows the inside of the passage divided by the beam member to a generation-of-electrical-energy module.
[0027] According to invention according to claim 5, a collecting area is increased according to the fall of an exhaust-gas temperature, and it is effective in the ability to adjust uniformly the temperature of the elevated-temperature edge of a generation-of-electrical-energy module by the vertical style. In the downstream, it is effective in the ability to demonstrate the function as a support of a forcing load, realizing change of the collecting area for adjusting uniformly the temperature of the elevated-temperature edge of a generation-of-electrical-energy module by the vertical style according to invention according to claim 6.
[0028] According to invention according to claim 7, it is effective in the ability to form the beam with while [from an exhaust pipe wall to / beam / the exhaust pipe wall of another side] in the forcing direction simple. According to invention according to claim 8, said plate-like part material can support the load of the direction where the root part of a beam member falls, and it is effective in the ability to enlarge an attachment load more.
[0029] According to invention according to claim 9, since the thermal expansion of each beam member is absorbable by bending of plate-like part material, even if a differential thermal expansion arises between beam members, it is effective in the ability to prevent heat deformation of an exhaust pipe.
[0030]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on a drawing. Drawing 1 is the schematic diagram showing the whole exhaust heat power-plant configuration for automobiles in the gestalt of operation.
[0031] The exhaust heat power plant 1 is constituted in this drawing 1 by the generation-of-electrical-energy module (thermoelement) 4 attached so that one side face may contact the outside surface of the exhaust pipe 3 which derives the exhaust air 14 from the engine which is not illustrated, and the cooling jacket (cooling section) 5 attached in them as contacts the other side faces of this generation-of-electrical-energy module 4.
[0032] And in said generation-of-electrical-energy module 4, by producing a temperature gradient between elevated-temperature edge

4a in contact with the outside surface of an exhaust pipe 3, and low-temperature edge 4b in contact with a cooling jacket 5, the generation-of-electrical-energy module 4 is made to generate electromotive force, and emission temperature energy is collected as electrical energy.
[0033] Said cooling jacket 5 constitutes the path which circulates through the cooling water 2 as a cooling medium between radiators 15, in the pump turbine 18 infixed in the downstream of this cooling jacket 5, it returns the cooling water which passed the cooling jacket 5 to a radiator 15, sends again into a cooling jacket 5 the cooling water which radiated heat with the radiator 15, and cools the other side faces of the generation-of-electrical-energy module 4.
[0034] By the flow of exhaust air, said pump turbine 18 consists of a turbine by which a rotation drive is carried out, and a screw which rotation of this turbine is delivered, and circulates cooling water in a circulation path using exhaust air energy.
[0035] Moreover, a thermostat 17 is infixed in the upstream of said radiator 15, and when the temperature of cooling water is low, the sink and the generation-of-electrical-energy module 4 have been made not to supercool cooling water at the branching path 19 side which bypasses said radiator 15.
[0036] Furthermore, when reserve Hwang 16 is attached to said radiator 15 and heat dissipation in a radiator 15 is not fully performed, said reserve Hwang 16 is driven and it is made to have promoted heat dissipation.
[0037] Drawing 2 (a) and (b) show the 1st operation gestalt of said exhaust heat power plant 1. The part in which the exhaust heat power plant 1 of said exhaust pipe 3 is infixed is formed in the flat rectangle cross section long to the longitudinal direction to the installation direction. And the generation-of-electrical-energy module 4 is attached in the top face and inferior surface of tongue of this exhaust pipe 3, respectively, and further, as the up-and-down generation-of-electrical-energy module 4 is put, the cooling jacket 5 of a vertical pair is attached.
[0038] While two or more collection-of-heat fins 21a and 21b of two kinds of size are formed, respectively, three beam members 22a, 22b, and 22c are formed in the building envelope of the above-mentioned exhaust pipe 3.
[0039] Said collection-of-heat fins 21a and 21b are installed along with a vertical flow direction so that it may reach throughout being set up by the head-lining side and base of the exhaust pipe 3 interior as the collection-of-heat fins 21a and 21b are located in a line with a longitudinal direction by turns, and the generation-of-electrical-energy module 4 being formed in them. Moreover, to collection-of-heat fin 21a having the height which results near the longitudinal plane of symmetry of the vertical direction of an exhaust pipe 3, collection-of-heat fin 21b is set as the height which recovers from the wall of an exhaust pipe 3 slightly, and ** is also with the head-lining side of the exhaust pipe 3 interior, and a base, and has shifted arrangement of the collection-of-heat fins 21a and 21b to the longitudinal direction.
[0040] The height and number are set up that said collection-of-heat fins 21a and 21b are for carrying out the collection of heat of the exhaust air heat, and transmitting to the generation-of-electrical-energy module 4, are having said collection-of-heat fins 21a and 21b which have big surface area in a flueway, should raise the transmission efficiency of exhaust air heat, and should make optimum temperature temperature of elevated-temperature edge 4a of the generation-of-electrical-energy module 4.
[0041] On the other hand, said three beam members 22a, 22b, and 22c are members of the shape of a wall which crosses the interior of an exhaust pipe 3 in the vertical direction, and is installed along with a vertical flow direction, and it goes across them throughout the exhaust pipe 3 with which the generation-of-electrical-energy module 4 is formed, and they are prepared. Said three beam members 22a, 22b, and 22c avoid said collection-of-heat fins 21a and 21b, are arranged at abbreviation regular intervals at a longitudinal direction, and thereby, the building envelope of an exhaust pipe is divided into four paths 3a-3d on a par with a longitudinal direction, and they serve as a configuration equipped with two or more collection-of-heat fins 21a and 21b in each path 3a-3d.
[0042] the half-rate configuration which consists an exhaust pipe 3 of two up-and-down components (31a, 31b) here -- carrying out -- each half-segmented ****** 31a and 31b -- beforehand -- said collection-of-heat fins 21a and 21b -- welding and a low -- the price -- deleting -- appearance -- carrying out -- etc. -- by forming in one When the half-rate components 31a and 31b are combined, a configuration equipped with the collection-of-heat fins 21a and 21b as shown in drawing 2 (a) and (b) can be obtained.
[0043] moreover, the beam members 22a, 22b, and 22c -- said -- a half -- one side of the rate components 31a and 31b -- welding and a low -- the price -- deleting -- appearance -- carrying out -- etc. -- it forms in one and can consider as a configuration as shown in drawing 2 (a) and (b) by combining the half-rate components 31a and 31b. Moreover, after combining the half-rate components 31a and 31b, said beam members 22a, 22b, and 22c can be inserted in the predetermined location inside an exhaust pipe 3, and the upper limit and lower limit of these beam members 22a, 22b, and 22c can also be considered as the configuration fixed to the half-rate components 31a and 31b by approaches, such as point attachment welding.
[0044] According to the above-mentioned configuration, since it is the configuration which crosses the interior of an exhaust pipe 3 along the direction where the forcing load of the generation-of-electrical-energy module 4 is added, said beam members 22a, 22b, and 22c will support a forcing load, can prevent deformation of exhaust pipe 3 front face by said forcing load, can prevent increase of the contact thermal resistance by deformation, and can obtain an expected generation-of-electrical-energy output. Moreover, since it contributes to increase of the heating value whose beam members 22a, 22b, and 22c also demonstrate a collection-of-heat operation, and conduct it to the generation-of-electrical-energy module 4, increase of generating efficiency can also be aimed at. [as well as the collection-of-heat fins 21a and 21b]
[0045] Drawing 3 (a) and (b) show the 2nd operation gestalt of said exhaust heat power plant 1. In addition, the same sign is given to the same element as the 1st operation gestalt shown in drawing 2 (a) and (b), and explanation is omitted.
[0046] With the 2nd operation gestalt, it does not have the beam members 22a, 22b, and 22c shown with the 1st operation gestalt. instead of -- the half-rate components 31a and 31b -- when the location in the longitudinal direction of the collection-of-heat fins 21a and 21b which are alike, respectively and are formed is arranged by the upper and lower sides and the half-rate components 31a and 31b are combined, it is made to be compared in the tip of collection-of-heat fin 21a installed to a longitudinal plane of symmetry That is, the beam member which crosses an exhaust pipe 3 in the vertical direction is constituted by collection-of-heat fin 21a of the pair compared in a longitudinal plane of symmetry.
[0047] According to the above-mentioned configuration, it can push by collection-of-heat fin 21a compared in a longitudinal plane of symmetry, a load can support, deformation of exhaust pipe 3 front face by said forcing load can be prevented, increase of the contact thermal resistance by deformation can be prevented, and an expected generation-of-electrical-energy output can be obtained. Moreover, if it is the configuration which uses together collection-of-heat fin 21a as a beam member, a beam will be formed in coincidence by forming collection-of-heat fin 21a in the half-rate components 31a and 31b, and welding in a back process will be unnecessary, and can lessen the class of components.
[0048] Drawing 4 (a) and (b) show the 3rd operation gestalt of said exhaust heat power plant 1. The plate-like part material 24 is put and it is made to have fixed with this 3rd operation gestalt between collection-of-heat fin 21a which counters in said 2nd operation gestalt and was prepared.
[0049] Since according to this configuration collection-of-heat fin 21a which is installed up and down from the plate-like part material

24, and results in the wall of an exhaust pipe 3 functions as a beam member and the forcing load of the generation-of-electrical-energy module 4 supports, deformation of exhaust pipe 3 front face by said forcing load can be prevented, increase of the contact thermal resistance by deformation can be prevented, and an expected generation-of-electrical-energy output can be obtained. Moreover, since the load of the direction where the root (bond part to the wall of an exhaust pipe 3) of collection-of-heat fin 21a carries out buckling, and falls supports by the plate-like part material 24, an attachment load can be enlarged more.

[0050] Drawing 5 (a) and (b) show the 4th operation gestalt of said exhaust heat power plant 1. The plate-like part material 24 is put and it is made to have fixed with the 4th operation gestalt between collection-of-heat fin 21a which shifted and arranges the collection-of-heat fins 21a and 21b which carried out opposite arrangement to a longitudinal direction with the 3rd operation gestalt, and is arranged by shifting to mutual [this].

[0051] While according to this configuration the forcing load of the generation-of-electrical-energy module 4 can be supported by collection-of-heat fin 21a and buckling of the root of collection-of-heat fin 21a can be prevented, the differential thermal expansion of each collection-of-heat fin 21a is absorbable by bending of the plate-like part material 24.

[0052] That is, in the location where collection-of-heat fin 21a contacts the plate-like part material 24, since opposite arrangement of the collection-of-heat fin 21a by the side of reverse is not carried out, when collection-of-heat fin 21a carries out thermal expansion, the plate-like part material 24 bends and said thermal expansion can be absorbed. therefore, exhaust air flow distribution dispersion etc. -- the temperature of each collection-of-heat fin 21a -- a difference -- being generated -- each collection-of-heat fin 21a -- although irregularity arises in the plate-like part material 24 by this differential thermal expansion even if it is alike, respectively and a differential thermal expansion arises, it can prevent that deformation arises on the front face of an exhaust pipe 3, i.e., the clamp face of the generation-of-electrical-energy module 4.

[0053] Drawing 6 (a), (b), and (c) show the 5th operation gestalt of said exhaust heat power plant 1. To the 1st operation gestalt shown in drawing 2 (a) and (b), the number of the collection-of-heat fins 21 increases as the downstream of exhaust air flow, and this 5th operation gestalt is considered as the configuration to which the downstream becomes [the height of each collection-of-heat fin 21] high.

[0054] namely, -- although the configuration of the collection-of-heat fin 21 in the cross section A which is the upstream most is the same as drawing 2 (b) which shows the 1st operation gestalt -- the height of collection-of-heat fin 21b -- the downstream -- a step --- like -- increasing -- the location of a cross section B -- the height of collection-of-heat fin 21b -- collection-of-heat fin 21a and abbreviation -- it has same extent. Furthermore, in addition to the collection-of-heat fins 21a and 21b, in a cross section C, collection-of-heat fin 21c lower than these collections-of-heat fins 21a and 21b is prepared among the collection-of-heat fins 21a and 21b, respectively. And the height of said collection-of-heat fin 21c increases in step by the downstream, and the height of the collection-of-heat fins 21a, 21b, and 21c has become abbreviation identitas in the height which reaches an abbreviation longitudinal plane of symmetry in the cross section D which is the downstream most.

[0055] the heating value which according to the above-mentioned configuration the downstream to which an exhaust-gas temperature falls is delivered to the generation-of-electrical-energy module 4 since a collecting area increases -- a vertical style -- abbreviation regularity -- carrying out -- the temperature of elevated-temperature edge 4a of the generation-of-electrical-energy module 4 -- homogeneity -- it can carry out -- with -- **** -- it can be made to generate electricity efficiently to homogeneity by the generation-of-electrical-energy module 4

[0056] Moreover, drawing 7 (a) and (b) are the 6th operation gestalt of said exhaust heat power plant 1 being shown, and using the same collection-of-heat fins 21a, 21b, and 21c (referring to drawing 6 (c)) as said 5th operation gestalt. To the 2nd operation gestalt shown in drawing 3 , the number of the collection-of-heat fins 21 increases as the downstream of exhaust air flow, and the height of each collection-of-heat fin 21 is considered as the configuration to which the downstream becomes high.

[0057] Furthermore, drawing 8 (a) and (b) are the 7th operation gestalt of said exhaust heat power plant 1 being shown, and using the same collection-of-heat fins 21a, 21b, and 21c (referring to drawing 6 (c)) as said 5th operation gestalt. To the 3rd operation gestalt which collection-of-heat fin 21a shown in drawing 4 counters, and puts the plate-like part material 24, the number of the collection-of-heat fins 21 increases as the downstream of exhaust air flow, and the height of each collection-of-heat fin 21 is considered as the configuration to which the downstream becomes high.

[0058] Moreover, drawing 9 (a) and (b) are the 8th operation gestalt of said exhaust heat power plant 1 being shown, and using the same collection-of-heat fins 21a, 21b, and 21c (referring to drawing 6 (c)) as said 5th operation gestalt. To the 4th operation gestalt which puts the plate-like part material 24 between collection-of-heat fin 21a shifted and arranged at the longitudinal direction shown in drawing 5 , the number of the collection-of-heat fins 21 increases as the downstream of exhaust air flow, and the height of each collection-of-heat fin 21 is considered as the configuration to which the downstream becomes high.

[0059] in addition, above-mentioned the 5- although the number of the collection-of-heat fins 21 increased as the downstream of exhaust air flow and the height of each collection-of-heat fin 21 considered as the configuration to which the downstream becomes high with the 8th operation gestalt, it is good also as a configuration to which it considers as the configuration to which only the number of collection-of-heat fins is changed, or only height is changed.

[0060] Moreover, it is also possible to consider as the configuration which distinguishes a beam member and a collection-of-heat fin clearly, for example, is equipped with cylinder-like a beam member and a collection-of-heat fin in an exhaust pipe, and it is also possible to consider as the configuration which is equipped only with a beam member in an exhaust pipe, and is not further equipped with a collection-of-heat fin.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The global placement Fig. showing the whole exhaust heat power-plant configuration.
[Drawing 2] The sectional view showing the 1st operation gestalt of an exhaust heat power plant.
[Drawing 3] The sectional view showing the 2nd operation gestalt of an exhaust heat power plant.
[Drawing 4] The sectional view showing the 3rd operation gestalt of an exhaust heat power plant.
[Drawing 5] The sectional view showing the 4th operation gestalt of an exhaust heat power plant.
[Drawing 6] The sectional view showing the 5th operation gestalt of an exhaust heat power plant.
[Drawing 7] The sectional view showing the 6th operation gestalt of an exhaust heat power plant.
[Drawing 8] The sectional view showing the 7th operation gestalt of an exhaust heat power plant.
[Drawing 9] The sectional view showing the 8th operation gestalt of an exhaust heat power plant.
[Description of Notations]
1 -- Exhaust heat power plant
2 -- Cooling water
3 -- Exhaust pipe
4 -- Generation-of-electrical-energy module
5 -- Cooling jacket
21a, 21b, 21c -- Collection-of-heat fin
22a, 22b, 22c -- Beam member
24 -- Plate-like part material

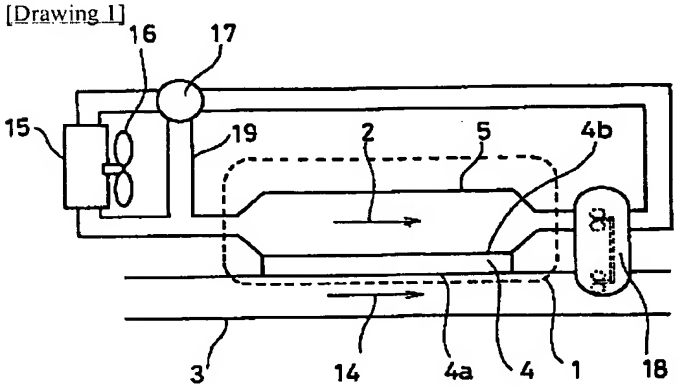
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

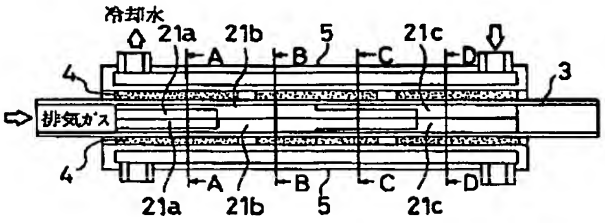
DRAWINGS

[Drawing 1]

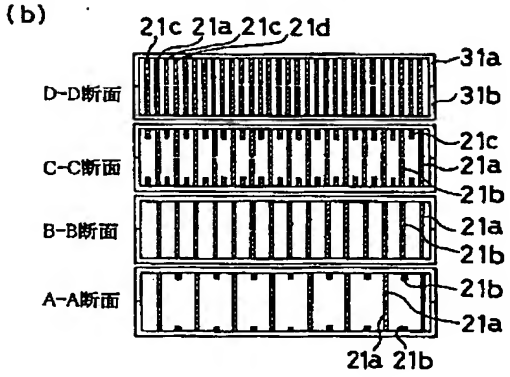


[Drawing 7]

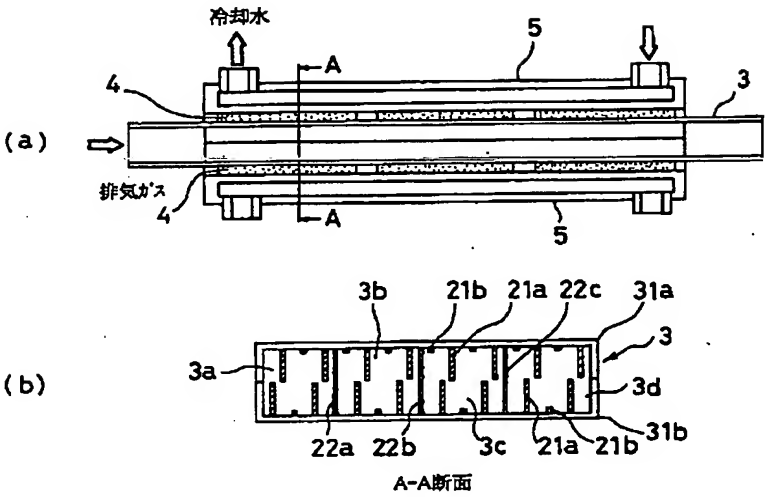
(a)



(b)



[Drawing 2]



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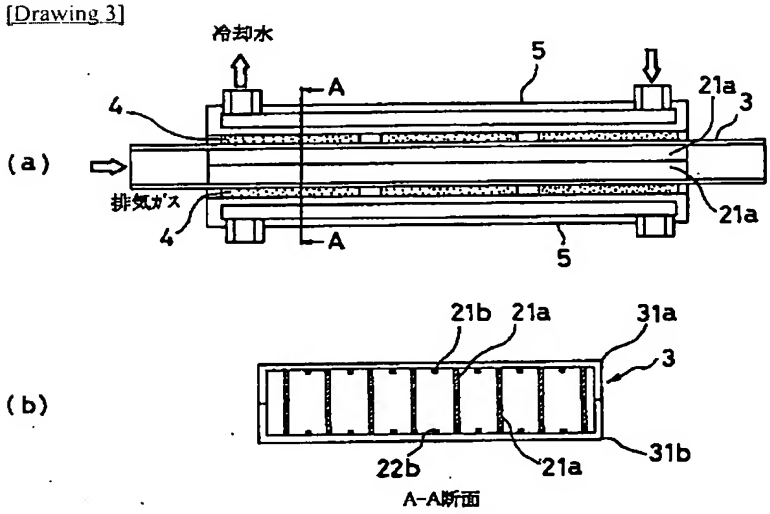
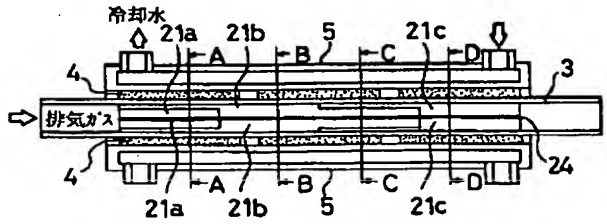
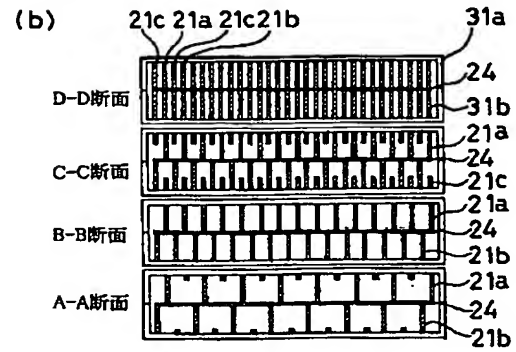


[Drawing 9]

(a)





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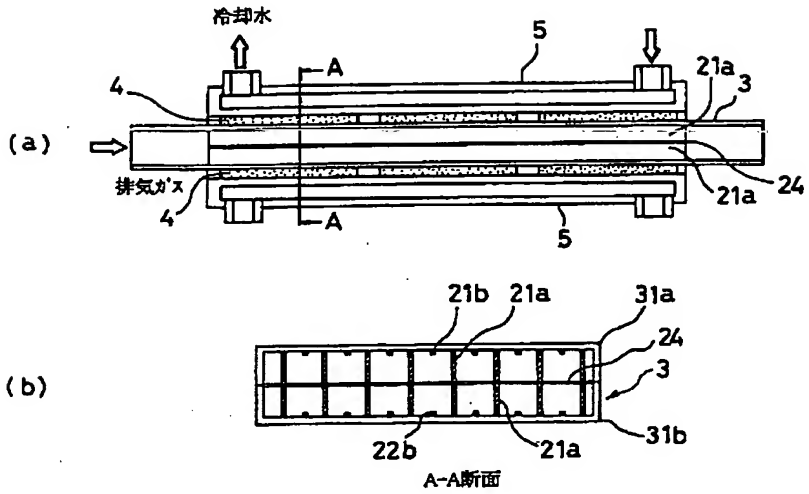

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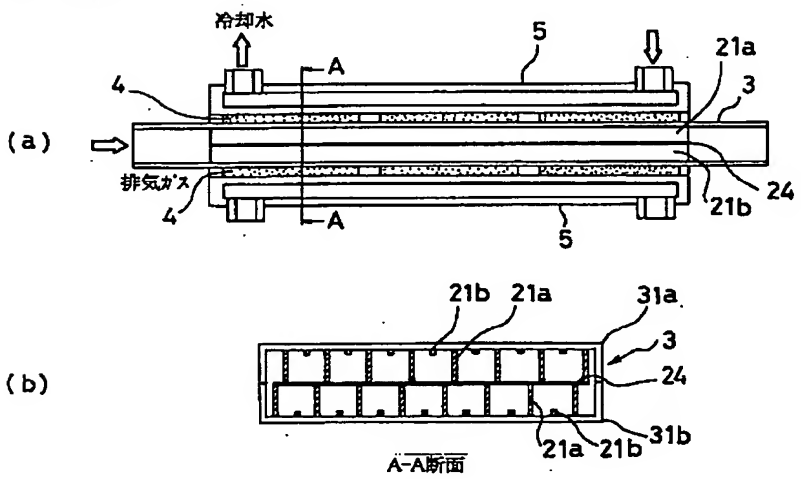
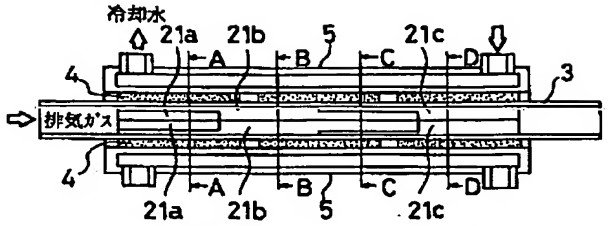


[Drawing 6]

(a)



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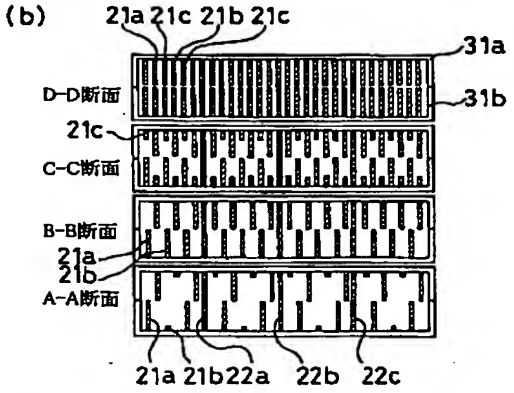
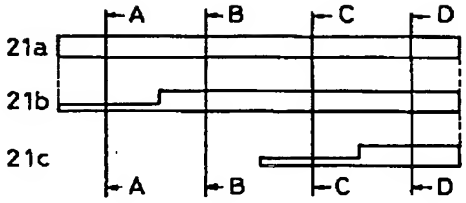
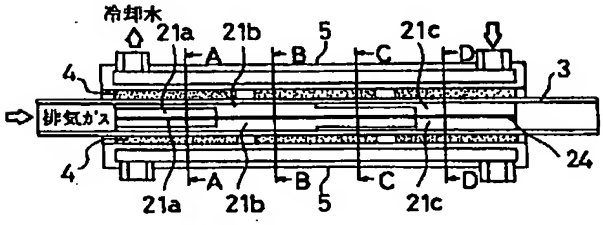


(c)

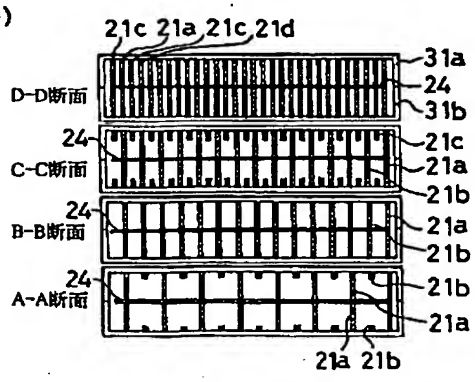


[Drawing 8]

(a)



(b)



[Translation done.]

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F01N 7/08
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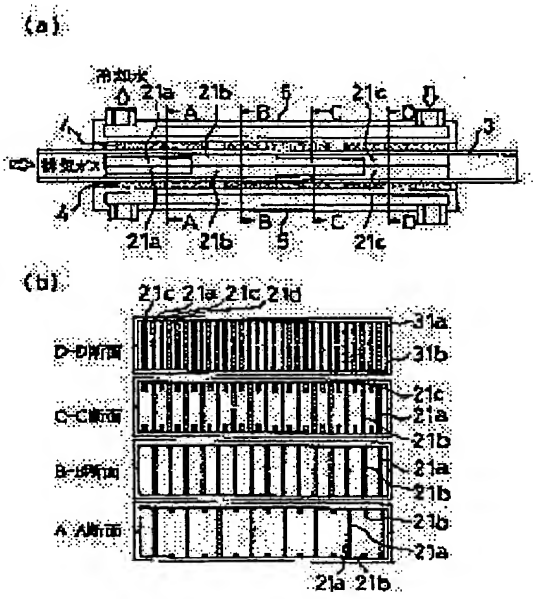
(21)Application number : 11-177003
(22)Date of filing : 23.06.1999

(71)Applicant : NISSAN MOTOR CO LTD
(72)Inventor : MUNEKIYO MASAYUKI

(54) EXHAUST HEAT GENERATOR FOR AUTOMOBILE

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent deformation of a surface of an exhaust pipe due to a pressing load of a generating module against the exhaust pipe and increase of contact heat resistance on an exhaust heat generator.
SOLUTION: A pressing load of a generating module 4 is supported by a heat collection fin 21a by constituting a beam member to cross in the vertical direction by striking the heat collection fin 21a erected on a vertical inwall against the neighbourhood of a central surface on an exhust pipe 3 on which the generating module 4 is provided. Additionally, temperature of a high temperature end of the generating module is controlled constant by increasing height of a heat collection fin 21b which is low in height on an upstream end on the downstream side, increasing height of a heat collection fin 21c provided from an intermediate position on the downstream side and increasing the number and height of the collection fins larger and higher toward the downstream side.



LEGAL STATUS

[Date of request for examination]

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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7/08		7/08	Ｚ	
Ｈ０２Ｎ　11/00		Ｈ０２Ｎ　11/00	Ａ	

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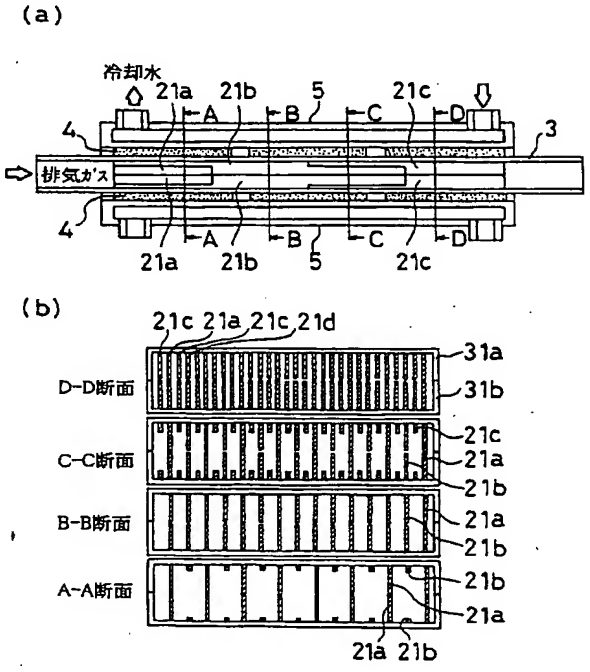
弁理士　笹島　富二雄

Ｆターム(参考)　3G004 BA05 DA01 DA14 DA21 GA06

(54)【発明の名称】　自動車用排熱発電装置

(57)【要約】
【課題】排熱発電装置において、発電モジュールの排気管に対する押し付け荷重によって排気管の表面が変形し、接触熱抵抗が増大することを防止する。
【解決手段】発電モジュール４が設けられる排気管３において、上下の内壁に立設させた集熱フィン２１ａを、中心面付近で突き当てて上下方向に横断する梁部材を構成し、発電モジュール４の押し付け荷重を、前記集熱フィン２１ａで支えるようにする。また、上流端で高さの低い集熱フィン２１ｂを下流側で高さを増大させ、更に、中間位置から設ける集熱フィン２１ｃを下流側で高さを増大させ、集熱フィンの数及び高さが下流側ほど増大するようにして、発電モジュールの高温端の温度を一定に制御する。



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【特許請求の範囲】
【請求項１】エンジンからの排気を導出する排気管の外面に発電モジュールの高温端を押し付けて取り付け、該発電モジュールにより排温エネルギーを電気エネルギーとして回収する自動車用排熱発電装置において、
前記排気管内部に前記押し付け荷重を支える梁部材を設けたことを特徴とする自動車用排熱発電装置。
【請求項２】前記発電モジュールの高温端が押し付けられる前記排気管が扁平な略長方形の横断面形状に形成され、該長方形横断面の長辺に対して前記発電モジュールの高温端を押し付けて取り付ける構成であることを特徴とする請求項１記載の自動車用排熱発電装置。
【請求項３】前記梁部材が、前記排気管内部を前記押し付け方向に略沿って横断し、かつ、上下流方向に略沿って延設される壁状に形成されることを特徴とする請求項１又は２に記載の自動車用排熱発電装置。
【請求項４】前記梁部材と平行に集熱フィンを立設させたことを特徴とする請求項３記載の自動車用排熱発電装置。
【請求項５】前記集熱フィンの高さと数との少なくとも一方を、前記排気管の下流側ほど増加させたことを特徴とする請求項４記載の自動車用排熱発電装置。
【請求項６】前記押し付け方向に略平行に、かつ、上下流方向に略沿って前記排気管の内壁に立設させた集熱フィンの高さを、前記排気管の下流側ほど増加させ、前記集熱フィンが下流側で前記梁部材を兼ねるよう構成したことを特徴とする請求項３記載の自動車用排熱発電装置。
【請求項７】前記押し付け方向における一方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端と、他方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端とを突き合わせる構成としたことを特徴とする請求項１～６のいずれか１つに記載の自動車用排熱発電装置。
【請求項８】前記押し付け方向における一方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端と、他方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端との間に、板状部材を挟み込む構成としたことを特徴とする請求項１～６のいずれか１つに記載の自動車用排熱発電装置。
【請求項９】前記一方の排気管内壁に立設される梁部材と、前記他方の排気管内壁に立設される梁部材とが、前記押し付け方向に直交する方向に相互にずれて配置されることを特徴とする請求項８記載の自動車用排熱発電装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は自動車用排熱発電装置に関し、詳しくは、エンジンの排温エネルギーを電気エネルギーとして回収する装置に関する。

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【０００２】
【従来の技術】従来、自動車用排熱発電装置としては、特開平６－０８１６３９号公報，特開平８－２６１０６４号公報，特開平１０－２３４１９４号公報に開示されるようなものがあった。
【０００３】このものは、エンジンからの排気を導出する排気管の外表面に、発電モジュールの一側面を接触させて取り付けると共に、該発電モジュールの他側面を水冷式や空冷式の冷却部に接触させる。
【０００４】前記発電モジュールは、半導体などの熱電素子材料で構成され、そのゼーベック効果を利用して発電を行うものであり、温度の高い排気管と温度の低い冷却部により発電モジュールの高温端と低温端との間に温度差を生じさせて発電を行う。前記発電モジュールの効率は、一般的に、高温端の温度が高くなるほど、また、高温端と低温端との間の温度差が大きくなるほど大きくなる。
【０００５】
【発明が解決しようとする課題】ところで、前記排熱発電装置により自動車の燃費向上を図るためには、エンジンの低出力領域で最大の発電出力を得る必要があり、そのためには、排気温度の低い状態で発電モジュールの高温端温度と低温端温度との温度差をなるべく大きくすべく、発電モジュールの低温端温度はできるだけ低く、かつ、高温端温度はできるだけ排気温度に近づけて高くなるようにする必要がある。
【０００６】このため、従来では、冷却部と発電モジュールとの間、及び、排気管と発電モジュールとの間の組付け荷重（押し付け荷重）を大きくすることで、接触熱抵抗をなるべく小さくするようにしていた。
【０００７】しかし、発電モジュールが取り付けられる排気管は、発電モジュールの平坦な設置面積を確保すべく扁平な略長方形の横断面形状に形成され、この長方形横断面の長辺に対して発電モジュールの高温端を押し付けて取り付ける構成としていたため、大きな組付け荷重で排気管と発電モジュールとを組付けると、排気管の長方形横断面の長辺が撓んで、発電モジュールの高温端と排気管との接触面積が低下すると同時に接触面の面圧が低下し、これによって接触熱抵抗が増大し、発電出力が低下するという問題があった。
【０００８】本発明は上記問題点に鑑みなされたものであり、発電モジュールが取り付けられる排気管の組付け荷重による変形を防止することで、接触熱抵抗の増大を防止し、以って、発電出力の低下を防止できる自動車用排熱発電装置を提供することを目的とする。
【０００９】また、前記排気管の組付け荷重による変形を防止すると共に、上下流位置に応じた熱抵抗の調整が行える自動車用排熱発電装置を提供することを目的とする。
【００１０】

【課題を解決するための手段】そのため請求項１記載の発明に係る自動車用排熱発電装置は、エンジンからの排気を導出する排気管の外面に発電モジュールの高温端を押し付けて取り付け、該発電モジュールにより排温エネルギーを電気エネルギーとして回収する自動車用排熱発電装置において、前記排気管内部に前記押し付け荷重を支える梁部材を設ける構成とした。

【００１１】かかる構成によると、排気管内部に設けた梁部材によって押し付け荷重に対する補強がなされ、排気管の押し付け荷重による変形を抑止する。請求項２記載の発明では、前記発電モジュールの高温端が押し付けられる前記排気管が扁平な略長方形の横断面形状に形成され、該長方形横断面の長辺に対して前記発電モジュールの高温端を押し付けて取り付ける構成とした。

【００１２】かかる構成によると、排気管が、扁平な略長方形の横断面形状に形成され、該長方形横断面の長辺に発電モジュールが取り付けられ、前記長辺に直交する方向の押し付け荷重が、排気管内部の梁部材によって支えられる。

【００１３】請求項３記載の発明では、前記梁部材が、前記排気管内部を前記押し付け方向に略沿って横断し、かつ、上下流方向に略沿って延設される壁状に形成される構成とした。

【００１４】かかる構成によると、梁部材は、排気管内部を仕切る壁状に形成され、該壁状の梁部材によって押し付け荷重が支えられる。また、かかる梁部材は、集熱フィンとしても機能し得ることになる。

【００１５】請求項４記載の発明では、前記梁部材と平行に集熱フィンを立設させる構成とした。かかる構成によると、押し付け荷重を支えるために設けられる壁状の梁部材と平行に、排気熱を集熱して発電モジュールに伝達する集熱フィンが立設され、排気熱が効率良く発電モジュールに伝達されるようにする。

【００１６】請求項５記載の発明では、前記集熱フィンの高さと数との少なくとも一方を、前記排気管の下流側ほど増加させる構成とした。かかる構成によると、集熱フィンの高さ及び／又は数を増大させると、伝熱面積が増大するから、排気温度が低下する下流側において集熱フィンの高さ及び／又は数を増大させることで、発電モジュールの高温端の温度が下流側で低下することが抑止される。

【００１７】請求項６記載の発明では、前記押し付け方向に略平行に、かつ、上下流方向に略沿って前記排気管の内壁に立設させた集熱フィンの高さを、前記排気管の下流側ほど増加させ、前記集熱フィンが下流側で前記梁部材を兼ねるよう構成した。

【００１８】かかる構成によると、集熱フィンは、上流側では集熱手段としてのみ機能するが、下流側では、その高さを増すことで押し付け荷重を支える梁部材としても機能し、集熱フィンの集熱面積の変化による熱抵抗の調整機能を発揮させつつ、押し付け荷重を支え得る構成とした。換言すれば、梁部材は集熱フィンとしての機能を発揮し得るものであり、上下流の全域で集熱面積の変化がないと熱抵抗の調整が行えないので、排気温度が低下する下流側では大きな集熱面積として梁部材としても機能させるが、排気温度が高い上流側では、集熱面積を減じることで梁部材として機能させずに、集熱の機能のみとする。

【００１９】請求項７記載の発明では、前記押し付け方向における一方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端と、他方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端とを突き合わせる構成とした。

【００２０】かかる構成によると、例えば、前記排気管を前記押し付け方向に直交する平面で２分割される半割り構成とし、該半割り部品を組み合わせたときに半割り部品のそれぞれに立設させた梁部材が略中心面で突き合わされて、押し付け方向における一方の排気管内壁から他方の排気管内壁に至る梁が構成される。

【００２１】請求項８記載の発明では、前記押し付け方向における一方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端と、他方の排気管内壁に立設され前記排気管の中心面に略至る梁部材の先端との間に、板状部材を挟み込む構成とした。

【００２２】かかる構成によると、梁部材の先端の間に挟み込まれる板状部材が、梁部材の付け根部分が倒れる方向の荷重を支えることになる。請求項９記載の発明では、前記一方の排気管内壁に立設される梁部材と、前記他方の排気管内壁に立設される梁部材とが、前記押し付け方向に直交する方向に相互にずれて配置される構成とした。

【００２３】かかる構成によると、一方の排気管内壁に立設される梁部材と、他方の排気管内壁に立設される梁部材とがずれて配置されるので、例えば梁部材が熱膨張した時に板状部材の撓みで前記熱膨張をそれぞれ吸収させることが可能となる。

【００２４】

【発明の効果】請求項１記載の発明によると、発電モジュールの押し付け荷重が梁部材で支えられることで排気管の変形を抑止でき、以って、発電モジュールの高温端と排気管との接触面積及び接触面の面圧の低下による発電出力の低下を抑止できるという効果がある。

【００２５】請求項２記載の発明によると、発電モジュールの平坦で広い設置面積を確保しつつ、排気管の変形を抑止して、所期の発電出力を得ることができるという効果がある。

【００２６】請求項３記載の発明によると、押し付け荷重を支えつつ、集熱フィンとしての機能を発揮させ得るという効果がある。請求項４記載の発明によると、梁部材で区画される流路内を流れる排気の熱を効率良く発電

モジュールに伝達することができるという効果がある。

【００２７】請求項５記載の発明によると、排気温度の低下に応じて集熱面積を増やし、発電モジュールの高温端の温度を、上下流で一定に調整できるという効果がある。請求項６記載の発明によると、発電モジュールの高温端の温度を上下流で一定に調整するための集熱面積の変化を実現しつつ、下流側においては、押し付け荷重の支えとしての機能を発揮させることができるという効果がある。

【００２８】請求項７記載の発明によると、押し付け方向における一方の排気管内壁から他方の排気管内壁に至る梁を、簡便に形成できるという効果がある。請求項８記載の発明によると、梁部材の付け根部分が倒れる方向の荷重を前記板状部材が支えることができ、組み付け荷重をより大きくできるという効果がある。

【００２９】請求項９記載の発明によると、梁部材それぞれの熱膨張を板状部材の撓みで吸収できるため、梁部材の間で熱膨張差が生じても、排気管の熱変形を防止できるという効果がある。

【００３０】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づき詳細に説明する。図１は、実施の形態における自動車用排熱発電装置の全体構成を示す概略図である。

【００３１】この図１において、排熱発電装置１は、図示しないエンジンからの排気１４を導出する排気管３の外表面に一側面が接触するように取り付けられる発電モジュール（熱電素子）４と、該発電モジュール４の他側面に接触するようにして取り付けられる冷却ジャケット（冷却部）５とによって構成される。

【００３２】そして、前記発電モジュール４において、排気管３の外表面と接触する高温端４ａと、冷却ジャケット５と接触する低温端４ｂとの間で温度差を生じさせることで、発電モジュール４に起電力を発生させ、排温エネルギーを電気エネルギーとして回収するものである。

【００３３】前記冷却ジャケット５は、冷却媒体としての冷却水２をラジエータ１５との間で循環される経路を構成し、該冷却ジャケット５の下流側に介装されるポンプタービン１８により、冷却ジャケット５を通過した冷却水をラジエータ１５に送り返し、ラジエータ１５で放熱した冷却水を、再度冷却ジャケット５に送り込んで、発電モジュール４の他側面を冷却するようになっている。

【００３４】前記ポンプタービン１８は、排気の流れによって回転駆動されるタービンと、該タービンの回転が伝達されるスクリュウとからなり、排気エネルギーを利用して冷却水を循環経路内に流通させる。

【００３５】また、前記ラジエータ１５の上流側にはサーモスタット１７が介装され、冷却水の温度が低い場合に、前記ラジエータ１５をバイパスする分岐通路１９側に冷却水を流し、発電モジュール４が過冷却されないようにしてある。

【００３６】更に、前記ラジエータ１５には予備ファン１６が付設されており、ラジエータ１５における放熱が十分に行われないときに、前記予備ファン１６を駆動して放熱を促進させるようにしてある。

【００３７】図２（ａ），（ｂ）は、前記排熱発電装置１の第１の実施形態を示すものである。前記排気管３の排熱発電装置１が介装される部分は、延設方向に対する左右方向に長い扁平な長方形横断面に形成される。そして、該排気管３の上面と下面とにそれぞれ発電モジュール４が取り付けられ、更に、上下の発電モジュール４を挟み込むようにして上下一対の冷却ジャケット５が取り付けられる。

【００３８】上記排気管３の内部空間には、大小２種類の集熱フィン２１ａ，２１ｂがそれぞれ複数設けられると共に、３つの梁部材２２ａ，２２ｂ，２２ｃが設けられる。

【００３９】前記集熱フィン２１ａ，２１ｂは、排気管３内部の天井面及び底面に、集熱フィン２１ａ，２１ｂが左右方向に交互に並ぶようにして立設され、かつ、発電モジュール４が設けられる全域に及ぶように上下流方向に沿って延設される。また、集熱フィン２１ａが、排気管３の上下方向の中心面付近に至る高さを有するのに対し、集熱フィン２１ｂは、排気管３の内壁から僅かに立ち上がる高さに設定され、然も、排気管３内部の天井面と底面とで、集熱フィン２１ａ，２１ｂの配置を左右方向にずらしてある。

【００４０】前記集熱フィン２１ａ，２１ｂは、排気熱を集熱して発電モジュール４に伝達するためのものであり、排気通路内に大きな表面積を持つ前記集熱フィン２１ａ，２１ｂを備えることで、排気熱の伝達効率を向上させ、発電モジュール４の高温端４ａの温度を最適温度にすべく、その高さ及び数が設定される。

【００４１】一方、前記３つの梁部材２２ａ，２２ｂ，２２ｃは、排気管３の内部を上下方向に横断し、かつ、上下流方向に沿って延設される壁状の部材であり、発電モジュール４が設けられる排気管３の全域に渡って設けられる。前記３つの梁部材２２ａ，２２ｂ，２２ｃは、前記集熱フィン２１ａ，２１ｂを避けて左右方向に略等間隔に配置され、これにより、排気管の内部空間は、左右方向に並ぶ４通路３ａ～３ｄに分割され、各通路３ａ～３ｄ内に複数の集熱フィン２１ａ，２１ｂを備える構成となる。

【００４２】ここで、排気管３を、上下の２部品（３１ａ，３１ｂ）からなる半割り構成とし、各半割り部品３１ａ，３１ｂに、予め前記集熱フィン２１ａ，２１ｂを、溶接，ロー付け，削り出し等によって一体的に形成しておくことで、半割り部品３１ａ，３１ｂを組み合わせたときに、図２（ａ），（ｂ）に示すような集熱フィ

ン２１ａ，２１ｂを備える構成を得られる。

【００４３】また、梁部材２２ａ，２２ｂ，２２ｃは、前記半割り部品３１ａ，３１ｂの一方に溶接，ロー付け，削り出し等によって一体的に形成しておき、半割り部品３１ａ，３１ｂを組み合わせることで、図２（ａ），（ｂ）に示すような構成とすることができる。また、半割り部品３１ａ，３１ｂを組み合わせた後で、前記梁部材２２ａ，２２ｂ，２２ｃを排気管３の内部の所定位置に挿入し、該梁部材２２ａ，２２ｂ，２２ｃの上端及び下端を、半割り部品３１ａ，３１ｂに点付け溶接等の方法で固定する構成とすることもできる。

【００４４】上記構成によると、前記梁部材２２ａ，２２ｂ，２２ｃは、発電モジュール４の押し付け荷重が加わる方向に沿って、排気管３の内部を横断する構成であるから、押し付け荷重を支えることになり、前記押し付け荷重による排気管３表面の変形を防止することができ、変形による接触熱抵抗の増大を防止して、所期の発電出力を得ることができる。また、梁部材２２ａ，２２ｂ，２２ｃも、集熱フィン２１ａ，２１ｂと同様に、集熱作用を発揮して発電モジュール４へ伝導される熱量の増大に寄与するので、発電効率の増大も図れる。

【００４５】図３（ａ），（ｂ）は、前記排熱発電装置１の第２の実施形態を示す。尚、図２（ａ），（ｂ）に示した第１の実施形態と同一要素には同一符号を付して説明を省略する。

【００４６】第２の実施形態では、第１の実施形態で示した梁部材２２ａ，２２ｂ，２２ｃを備えず、代わりに、半割り部品３１ａ，３１ｂそれぞれに形成される集熱フィン２１ａ，２１ｂの左右方向における位置を上下で揃えて、半割り部品３１ａ，３１ｂを組み合わせたときに中心面まで延設される集熱フィン２１ａの先端が突き合わされるようにしてある。即ち、中心面で突き合わされる一対の集熱フィン２１ａによって、排気管３を上下方向に横断する梁部材が構成される。

【００４７】上記構成によると、中心面で突き合わされる集熱フィン２１ａによって押し付け荷重が支えられ、前記押し付け荷重による排気管３表面の変形を防止することができ、変形による接触熱抵抗の増大を防止して、所期の発電出力を得ることができる。また、集熱フィン２１ａを梁部材として併用する構成であれば、集熱フィン２１ａを、半割り部品３１ａ，３１ｂに形成することで同時に梁が形成されることになり、後工程における溶接が不要であり、また、部品の種類を少なくできる。

【００４８】図４（ａ），（ｂ）は、前記排熱発電装置１の第３の実施形態を示す。この第３の実施形態では、前記第２の実施形態において対向して設けるようにした集熱フィン２１ａの間に板状部材２４を挟み込み固定するようにしてある。

【００４９】かかる構成によると、板状部材２４から上下に延設されて排気管３の内壁に至る集熱フィン２１ａが梁部材として機能し、発電モジュール４の押し付け荷重が支えられるので、前記押し付け荷重による排気管３表面の変形を防止することができ、変形による接触熱抵抗の増大を防止して、所期の発電出力を得ることができる。また、集熱フィン２１ａの付け根（排気管３の内壁への結合部）が挫屈して倒れる方向の荷重が板状部材２４で支えられるので、組付け荷重をより大きくできる。

【００５０】図５（ａ），（ｂ）は、前記排熱発電装置１の第４の実施形態を示す。第４の実施形態では、第３の実施形態で対向配置させた集熱フィン２１ａ，２１ｂを左右方向にずらして配置し、この相互にずれて配置される集熱フィン２１ａの間に板状部材２４を挟み込み固定するようにしてある。

【００５１】かかる構成によると、発電モジュール４の押し付け荷重を集熱フィン２１ａで支えることができ、また、集熱フィン２１ａの付け根の挫屈を防止できる一方、各集熱フィン２１ａの熱膨張差を板状部材２４の撓みで吸収することができる。

【００５２】即ち、集熱フィン２１ａが板状部材２４に当接する位置では、逆側の集熱フィン２１ａが対向配置されないので、集熱フィン２１ａが熱膨張したときに、板状部材２４が撓んで前記熱膨張を吸収するようにすることができる。従って、排気流れの分布ばらつきなどによって各集熱フィン２１ａの温度に差が生じ、各集熱フィン２１ａそれぞれに熱膨張差が生じても、該熱膨張差によって板状部材２４に凹凸が生じるものの、排気管３の表面、即ち、発電モジュール４の取り付け面に変形が生じることを防止できる。

【００５３】図６（ａ），（ｂ），（ｃ）は、前記排熱発電装置１の第５の実施形態を示す。この第５の実施形態は、図２（ａ），（ｂ）に示した第１の実施形態に対して、集熱フィン２１の数が排気流れの下流側ほど多くなり、かつ、各集熱フィン２１の高さが下流側ほど高くなる構成としてある。

【００５４】即ち、最も上流側である断面Ａにおける集熱フィン２１の構成は、第１の実施形態を示す図２（ｂ）と同じであるが、集熱フィン２１ｂの高さが下流側でステップ的に増大し、断面Ｂの位置では、集熱フィン２１ｂの高さが集熱フィン２１ａと略同じ程度になっている。更に、断面Ｃでは、集熱フィン２１ａ，２１ｂに加えて、これら集熱フィン２１ａ，２１ｂよりも低い集熱フィン２１ｃが、集熱フィン２１ａ，２１ｂの間にそれぞれ設けられる。そして、前記集熱フィン２１ｃの高さが下流側でステップ的に増大し、最も下流側である断面Ｄにおいては、集熱フィン２１ａ，２１ｂ，２１ｃの高さが、略中心面に至る高さで略同一になっている。

【００５５】上記構成によると、排気温度が低下する下流側ほど集熱面積が増大するので、発電モジュール４に伝達される熱量を上下流で略一定にして、発電モジュール４の高温端４ａの温度を均一にすることができ、以っ

て、発電モジュール４で均一に効率良く発電を行わせることができる。

【００５６】また、図７（ａ），（ｂ）は、前記排熱発電装置１の第６の実施形態を示し、前記第５の実施形態と同様な集熱フィン２１ａ，２１ｂ，２１ｃ（図６（ｃ）参照）を用いることで、図３に示した第２の実施形態に対して、集熱フィン２１の数が排気流れの下流側ほど多くなり、かつ、各集熱フィン２１の高さが下流側ほど高くなる構成としてある。

【００５７】更に、図８（ａ），（ｂ）は、前記排熱発電装置１の第７の実施形態を示し、前記第５の実施形態と同様な集熱フィン２１ａ，２１ｂ，２１ｃ（図６（ｃ）参照）を用いることで、図４に示した集熱フィン２１ａが対向して板状部材２４を挟み込む第３の実施形態に対して、集熱フィン２１の数が排気流れの下流側ほど多くなり、かつ、各集熱フィン２１の高さが下流側ほど高くなる構成としてある。

【００５８】また、図９（ａ），（ｂ）は、前記排熱発電装置１の第８の実施形態を示し、前記第５の実施形態と同様な集熱フィン２１ａ，２１ｂ，２１ｃ（図６（ｃ）参照）を用いることで、図５に示した左右方向にずらして配置される集熱フィン２１ａの間に板状部材２４を挟み込む第４の実施形態に対して、集熱フィン２１の数が排気流れの下流側ほど多くなり、かつ、各集熱フィン２１の高さが下流側ほど高くなる構成としてある。

【００５９】尚、上記第５～第８の実施形態では、集熱フィン２１の数が排気流れの下流側ほど多くなり、かつ、各集熱フィン２１の高さが下流側ほど高くなる構成としたが、集熱フィンの数のみを変化させる構成とするか、又は、高さのみを変化させる構成としても良い。

【００６０】また、梁部材と集熱フィンとを明確に区別し、例えば円柱状の梁部材と集熱フィンとを排気管内に備える構成とすることも可能であり、更に、排気管内に梁部材のみを備え、集熱フィンを備えない構成とすることも可能である。

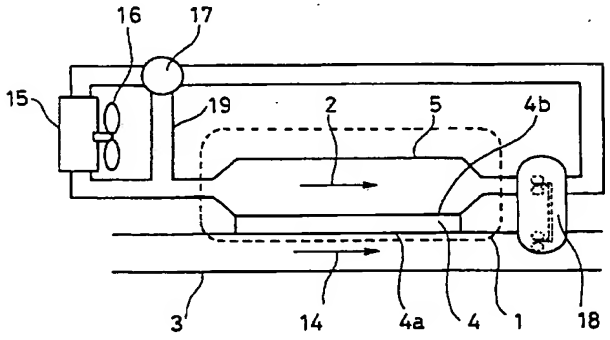
【図面の簡単な説明】

【図１】排熱発電装置の全体構成を示す概略配置図。
【図２】排熱発電装置の第１の実施形態を示す断面図。
【図３】排熱発電装置の第２の実施形態を示す断面図。
【図４】排熱発電装置の第３の実施形態を示す断面図。
【図５】排熱発電装置の第４の実施形態を示す断面図。
【図６】排熱発電装置の第５の実施形態を示す断面図。
【図７】排熱発電装置の第６の実施形態を示す断面図。
【図８】排熱発電装置の第７の実施形態を示す断面図。
【図９】排熱発電装置の第８の実施形態を示す断面図。

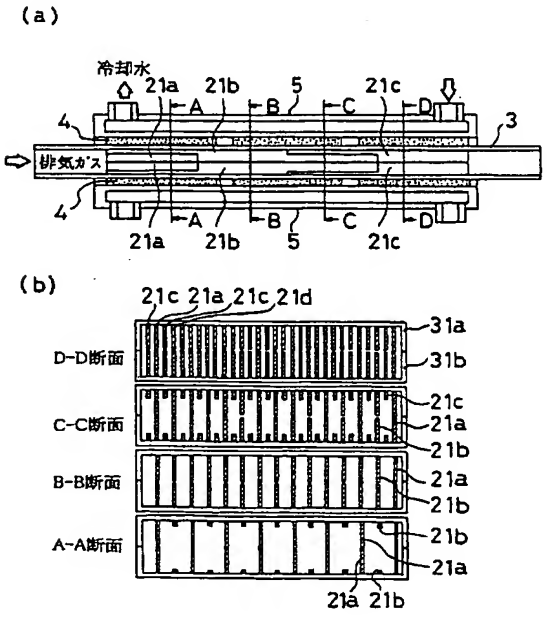
【符号の説明】

１…排熱発電装置
２…冷却水
３…排気管
４…発電モジュール
５…冷却ジャケット
２１ａ，２１ｂ，２１ｃ…集熱フィン
２２ａ，２２ｂ，２２ｃ…梁部材
２４…板状部材

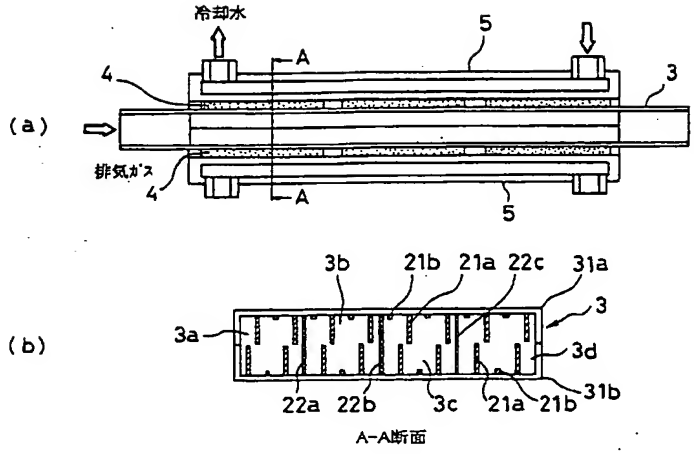
【図１】



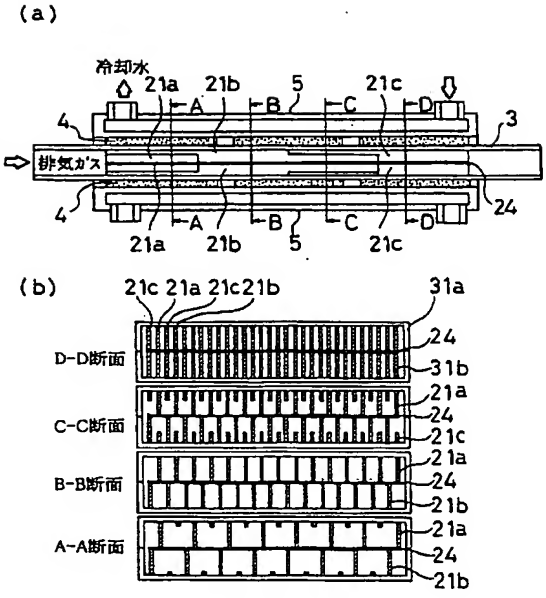
【図７】



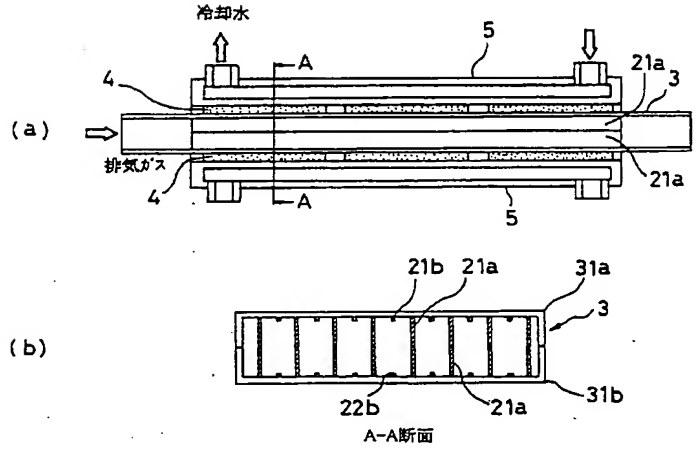
【図２】


(a)
冷却水
排気ガス
A
5
4
3
(b)
3b
21b
21a
22c
31a
3a
3d
22a
22b
3c
31b
A-A断面

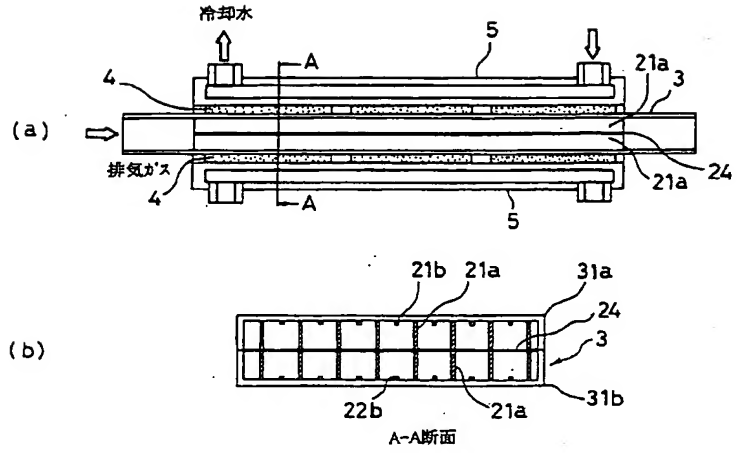
【図９】


(a)
冷却水
排気ガス
21a
21b
21c
A
B
C
D
5
4
3
24
(b)
21c 21a 21c 21b
31a
D-D断面
C-C断面
B-B断面
A-A断面
24
31b
21a
21c
21b

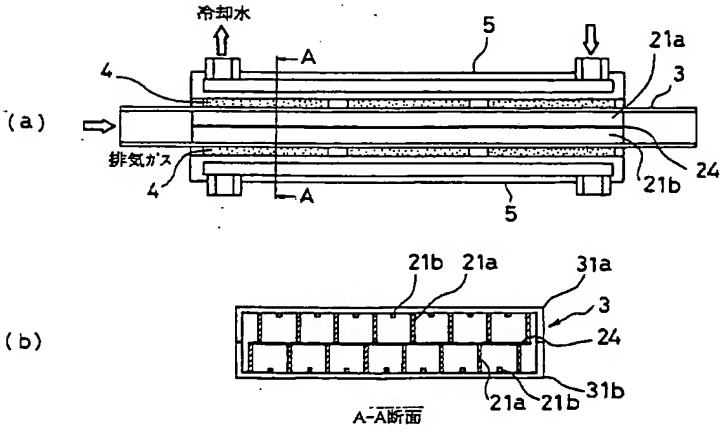
【図３】


(a)
冷却水
排気ガス
A
5
4
3
21a
(b)
21b
21a
31a
22b
31b
A-A断面

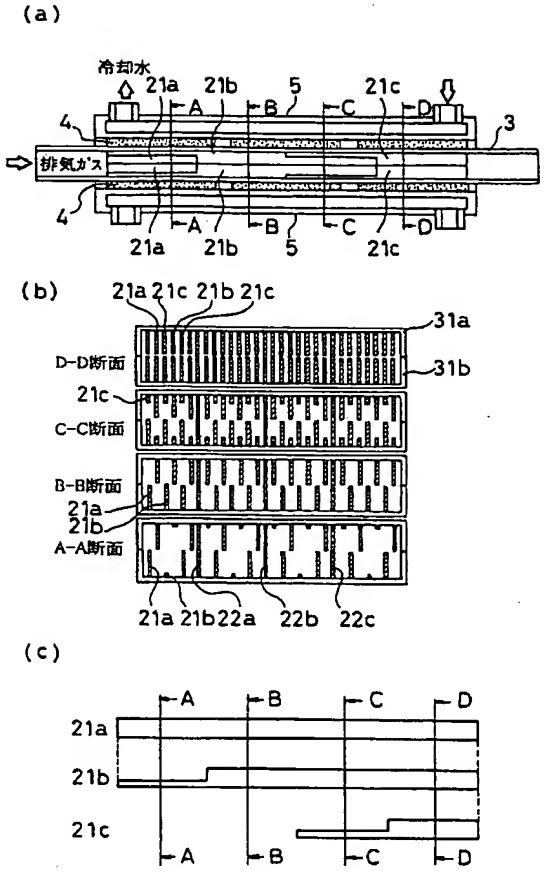
【図４】


(a)
冷却水
A
5
4
21a
3
排気ガス
24
A
5
(b)
21b
21a
31a
24
3
31b
22b
21a
A-A断面

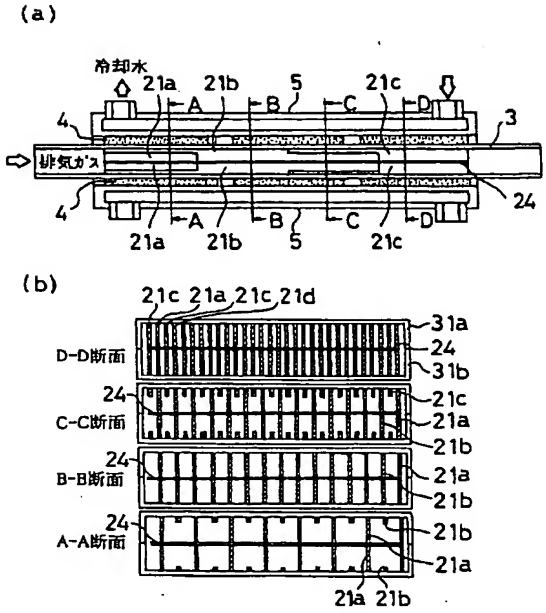
【図５】


(a)
冷却水
A
5
4
21a
3
排気ガス
24
21b
A
5
(b)
21b
21a
31a
3
24
31b
21a
21b
A-A断面

【図６】


(a)
冷却水
21a
21b
5
21c
A
B
C
D
4
3
排気ガス
(b)
21a 21c 21b 21c
31a
31b
D-D断面
21c
C-C断面
B-B断面
21a
21b
A-A断面
21a 21b 22a 22b 22c
(c)
21a
21b
21c

【図８】


(a)
冷却水
21a
21b
5
21c
A
B
C
D
4
3
排気ガス
24
(b)
21c 21a 21c 21d
31a
24
31b
D-D断面
24
21c
C-C断面
21a
21b
B-B断面
A-A断面
21a 21b